School Feeding Programme, Smallholder Farmers, and Development of Rural Areas in Nigeria

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ABSTRACT

Nigerian Federal government under the Muhammadu Buhari led-administration attempts to develop rural areas in Nigeria by introducing the Home-grown School Feeding (HGSF) Programme in 2016 in order to boost local agricultural production, create employment opportunities, reduce out-of-school children, boost nutrition and health status of schoolchildren, and ameliorate economic wellbeing of the rural areas as a strategy to grow and develop the Nigerian Economy. The study examines the linkages among School feeding Programme, smallholder farmers, and rural development in Nigeria. By comparing changes in agricultural productivity between treatment and control groups, the analysis reveals a positive but modest effect of the HGSF programme, with an

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R-squared value of 0.096 indicating that approximately 9.6% of the variability in agricultural output can be explained by the model. The findings align with existing literature that validates the role of school feeding programmes in enhancing agricultural productivity and food security. The study exposes the nation-wide impact of the policy given the huge investment in a single programme like the HGSF programme since implementation in the 35 states in Nigeria, including the Federal Capital Territory.

Keywords: Home-grown school feeding programme; smallholder farmers; economic development; rural; agricultural production; difference-in-differences (DID) method.

JEL Classification: O1, O5, Q1, R1.

1. INTRODUCTION

The Home-Grown School Feeding Programme (HGSF) is an important development policy that relates to at least six of the Sustainable Development Goals (SDGs). The HGSF programme is a policy linking education, gender equality, nutrition, health, social protection, local economies and agriculture. It is a single policy with multiple benefits.

The HGSF Programmes provide varieties of nutritious food safe for consumption, and usually obtained locally from smallholder's farmers, for the purpose of feeding schoolchildren (FAO & WFP, 2018). HGSF Programme also serves as a poverty alleviation programme. As Jukes et al. (2008) observed, enhancing nutrition and health status culminates into substantial educational benefits to the most vulnerable and poor. School feeding Programmes provide quickest gains for education via improved school participation and ancillary benefits for education seen via improvements in health status which results to improved learning and cognition. (Bundy et al., 2018). The HGSF Programme is important because it demonstrates a policy that has the prospects to convey positive synergies between agricultural development and social protection (Sumberg and Sabates-Wheeler, 2011).

Agricultural development is crucial to rural development. However rural areas can only develop if agriculture is developed. This is because a lot of rural dwellers are involved in agricultural practices as their main source of livelihood. The primary aim of agricultural development is basically to improve the material and social wellbeing of the people. Hence, good agricultural practices can improve the quality of life of rural dwellers thereby ensuring that enough food is available for present and future generations. Agricultural practices that take into cognizance climate change issues can increase

productivity without adversely affecting the environment or destroying natural resources (Udemezue and Osegbue, 2018).

The origin of school feeding dates back to 1880 in the United Kingdom with the institution of compulsory elementary education (Elementary Education Act, 1880), which provided basic meals to schoolchildren believed to be underfed and suffering from malnutrition (Passmore and Harris, 2004).

United States Federal Government invested in school feeding Programme as far back as in 1935 with promulgation of Agricultural Adjustment Act. However, the school feeding programme was instituted in 1946 with the establishment of school Launch program (Pollitt, et al, 1978).

As we have seen above, School Feeding Programmes are not peculiar to developing countries, but a global issue.

About half of the world's children who attend school, and about 310million children in low and middle income countries are fed every day at school. India is feeding over 100million children; Brazil is feeding 48million; China is feeding 44million; South is Africa and Nigeria each are feeding over 9million (WFP, 2019).

Nigeria recently launched the largest HGSF programme in Africa in 2016. This milestone is important for several reasons. First, the rate of school dropout is alarming. According to UNICEF (2019) report, despite the fact that primary education is compulsory and officially free in Nigeria, 1 out of every 5 of out-of-school children in the world resides in Nigeria and an estimated 10.5million children are not in school. According to NDHS (2018) report, Primary school net attendance ratio for age 6-12 children is 61 percent. Net primary school enrolment rate in

2016 was 65% (African Check, 2018), compared to Sub-Saharan average of 77.57% (World Bank, 2017). Second, hunger and malnutrition are severe problems in Nigeria. About 40 percent of all schoolchildren in Nigeria go to school hungry, and over 10million children are not in school (DFID, 2017). Nigeria is ranked second in terms of children with stunted growth in the world, with a national prevalence rate of 37% of children under age 5 (UNICEF, 2019). Research has shown that hungry children have poor cognitive abilities. According to Simeon and Granth-McGregor (1989), school feeding is likely to bestow gains to children's education via two channels- better cognitive function due to the relief of short-term hunger and better school attendance to ameliorate poverty. Third, Nigeria's high poverty rate and growing population call for concern. Nigeria has the highest population in Africa with a population of 190.9 million (World Bank, 2017) and with 87million people living below the poverty line (world poverty clock, 2018). This means that approximately 46% of Nigerians live in extreme poverty, which is worse than the Sub-Saharan average of 41% (World Bank, 2018). The population growth rate is higher than the GDP growth rate (In 2019, the Population growth rate was about 2.60% compared to GDP growth rate of about 2.33%; NBS, 2020). Finally, the scale of the HGSF intervention is enormous.

The main objectives of the HGSF programme as stated in the strategic plan (2016-2020) are basically to improve primary school enrolment and completion, improve health and nutritional status of school children, stimulate local agricultural production, and create job opportunities thereby improving family wellbeing and state economy.

The HGSF Programme is one of the five Social Investment Programmes of the Federal Government of Nigeria under the current administration and the most extensive social investment programme in Nigeria's history. ₦500billion (the equivalent of $1.63Billion) was budgeted for implementation of HGSF in the 2016 budget out of ₦6trillion budgeted for the year. The Nigerian HGSF programme policy document (plan) (2016-2020) states that the programme shall provide a meal per school day to every public primary school pupils in grades 1 to 3 in Nigeria. Presently over 9 million pupils are being fed daily across 35 states, including the Federal Capital Territory (HGSF, 2020).

In 2004, the Federal Government of Nigeria carried out a pilot survey of Home-Grown School Feeding (HGSF) Programme in 12 states (Kebbi, Yobe, Kano, Bauchi, Ogun, Osun, Rivers. Cross River, Nassarawa, Kogi, Enugu and Imo) and Federal Capital Territory (Abuja). The programme was discontinued in less than one year of commencement but Osun, and Kano states continued to implement the programme. The programme was stopped majorly due to lack of government funding, inadequate policy and legal framework, lack of water and sanitation facilities, and insufficient monitoring and evaluation. Osun state was incredibly successful because the state government did not only redesigned and scaled up the programme but was also involved in the implementation and funding of the programme. The success stories of HGSF programme in Osun state tagged "O'meals" and partly Home-Grown School Feeding and Health Programme (HGSFHP) in Kano state, led to Federal Government's decision to extend the programme to all the 36 states in Nigeria, including the FCT. The redesigned HGSF programme was launched in 2016 and housed under the presidency, precisely under the office of the vice president. This differs from the previous HGSF programme that was managed by the ministry of education. This also demonstrates the seriousness the federal government has attached to the programme. In 2020, the HGSF programme has been implemented in 35 states in Nigeria. About 107,862 cooks have been engaged, 54,952 schools are benefiting from the programme, and over 9.9 million pupils are being fed daily. (HGSF, 2020).

In recent times, attention has shifted from Donor-led to government-led School Feeding Programmes. The global partners provide technical assistance for high-quality, efficient and effective Programmes, while the governments provide funding.

Despite the Nigerian government's significant investment in the Home-Grown School Feeding (HGSF) programme, the programme's impact on local agricultural production, rural development, and schoolchildren's well-being remains insufficiently explored. There is a lack of empirical evidence evaluating how effectively the programme contributes to these areas, particularly at the national level. This study therefore aims to examine the relationship between the HGSF programme, smallholder farmers, and rural development in Nigeria. The

study also seeks to assess the programme's contributions to local agricultural production, employment opportunities, and the overall economic well-being of rural areas with respect to primary school enrolment and completion rates, health and nutritional status of schoolchildren, local agricultural production and rural employment.

2. LITERATURE REVIEW

The National Home-Grown School Feeding Programme (NHGSFP) in Nigeria has shown significant positive impacts on rural communities and smallholder farmers. Studies indicate that the program improves food security, health, and educational outcomes for school children while stimulating job creation and boosting the rural economy (Nduka Elda Okolo-obasi & Uduji, 2022; Msughve Akiika et al., 2024). The NHGSFP has increased school enrollment, reduced absenteeism, and enhanced academic performance (Msughve Akiika et al., 2024). It has also improved the food security status of participating smallholder farmers, with 40% of beneficiary households being food secure compared to 20% of non-beneficiaries (Bulus Barnabas et al., 2023). The program addresses malnutrition, which affects 42% of Nigerian school children and is responsible for 49% absenteeism (Yunusa et al., 2012). However, challenges remain, such as limited access to markets for local farmers and issues in the recruitment process for vendors (Msughve Akiika et al., 2024).

The literature review is divided into theoretical literature review, and empirical literature review. The theoretical foundation of this study is rooted in several key theories that together explain the potential impact of the Home-Grown School Feeding (HGSF) programme on rural development. First, the Theory of Social Change underpins the HGSF programme by positing that social investment in agriculture and rural development can stimulate both agricultural evolution and improvements in rural livelihoods (Sumberg and Sabates-Wheeler, 2011). Building on this, the Theories of Agricultural Development, including the Frontier Model, Conservation Model, and Urban-Industrial Impact Model, provide a framework for understanding how agricultural growth can drive broader economic and social development. These models highlight the transition from traditional agricultural practices to more efficient systems, with the Diffusion Model further emphasizing the importance of knowledge dissemination to increase productivity among farmers.

Furthermore, the High Pay-Off Input Model by Ruttan (1977) complements this view by suggesting that planned investments in high-yield inputs can shift an economy from traditional to modern agricultural practices, enhancing productivity. In addition, Growth Stage Theories such as List's stages of development and Rostow's Learning Sectors theory offer insights into the transition from agricultural to industrial economies. These theories assign agriculture a crucial role in the development process, particularly in rural areas, and align with the goals of the HGSF programme in stimulating local agricultural production and rural employment. Lastly, the Harrod-Domar Theory of capital fundamentalism in 1939 and the Endogenous Growth Theory of 1987 provide further context by revealing the importance of both physical and human capital accumulation in driving economic growth. Together, these theories illustrate how investments in agricultural development, coupled with educational and nutritional improvements, can create a synergistic effect that boosts rural development, local economies, and overall national progress. This theoretical framework supports the central premise of this study, which seeks to ascertain the impact of the HGSF programme on rural development in Nigeria.

2.1 Theory of Social Change

The theory of social change is the theory underpinning the HGSF programme. The theory posits that the benefits from social investment programme and agricultural development are strong enough to stimulate the evolution of agriculture and improvement of rural livelihood in Sub-Saharan Africa (Sumberg and Sabates-Wheeler, 2011).

2.2 Theories of Agricultural Development

The study reviewed the Frontier Model which talked about creation of new continents in the 18th and 19th centuries as a strategy for expansion of agricultural production.

The Conservation Model emanates from the advancement in crop and animal husbandry which could be traced back to England's agricultural revolution and soil exhaustion concept of German soil scientist and Chemist. The conservation model of agricultural

development evolves from the advancement in livestock husbandry and crop production associated with England's agricultural development and the idea of soil exhaustion propagated by the early German chemists and soil scientist. The conservation model talked about moving from complicated land and labour-intensive farming system to more efficient system.

The Urban-Industrial Impact Model is accredited to Van Thumen in 1955, who initially tried to elucidate geographical differences in the intensity of farming especially as regards the productivity of labour in an advanced economy. However, the model was later expanded to explain the efficient performance of the product and factor markets linking non-agricultural and agricultural environments characterized by growing Urban-Industrial development.

The Diffusion Model emanated based on observation of empirical results on sustainable variations in land and labour productivity among farmers across different regions. It promotes agricultural development via more effective distribution of technical knowledge and closing the productivity gap among farmers in different regions.

The High Pay-Off Input Model was propounded by Ruttan in 1977 and he is of the view that the secret of moving from traditional agricultural society to productive society is to make a planned investment that will result to availability of high pay-off input to farmers in poor countries.

Growth Stage Theories and Agricultural Development Policy:

Industrial fundamentalism: The proponents of industrial fundamentalism are List (1932) and Hoselitz (1963).

Hoselitz pointed out 3 major patterns in German literature in the 19th century. These are: Segmentation premised on shifts in occupational distribution, classification premised on the changes in the degree of economic integration, and segmentation based on variations in the system of property rights and changes associated with economic ideology.

List differentiates 5 stages of development: These are: Savage stage, Pastoral stage, Agricultural stage, Manufacturing stage; and Commercial stage.

List main focus was to demonstrate the positive role of industrial protectionism for societies transiting from a lofty level of agriculture development to industrialization.

Structural Transformation (Fisher Clark) was accredited to by A.G.B Fisher and Colin Clark. Fisher stressed the gradual shift of investment and employment from primary activities to secondary activities, and then to tertiary production which leads to economic progress. According to Clark, economic growth is achieved by increase in output per head in any sector and second by the transfer of labour from sectors with low output per head.

Learning Sectors was propagated by Rostow. He identified 5 stages in an attempt to describe the transition from a primitive society to a modern society. These stages are: traditional society, pre-conditions for take-off, take-off, drive to maturity; and the age of high mass consumption.

Rostow was mainly concerned with the process by which a society transition from one developmental stage to another and his analysis was done with the aim of providing policy guidance to the government of the developing countries.

All three growth stage theories reviewed so far addressed the issue of transition from an agricultural society to an industrial economy as the main problem of development policy. However, Rostow's postulation is the only one which specifically assign a dynamic role for the agricultural sector in the transition process.

2.3 Theories of Physical and Human Capital

The harrod-domar theory: The Harrod-Domar theory of capital fundamentalism in 1946, which posits that physical capital accumulation is the major determinants of economic growth. They believe that the rate of growth of the economy is a function of the saving rate and the output-capital ratio (Boianovsky, 2018).

The endogenous growth theory: The Endogenous Growth Theory by Paul Romer (1986) describes the interaction between technological knowledge and the various structures of the economy, and how such an interaction leads to economic growth. (Aghion & Hawitt 1998). According to Aghion & Hawitt the endogenous growth theory provides a potent

dynamic engine of analysis that could be used to study not just economic growth but also many other similar phenomena, such as education or human capital in an economy or society.

2.4 Empirical Literature

A review of the existing literature shows that a lot of studies have been carried out on school feeding programme the world over. While some of them used descriptive method of study (Like Mukanyirigira, 2010; Mazinga, 2010; Guleid, et al, 2010) others used empirical method mainly Randomized Control Trials and Difference-in-Difference models (like Bundy, et al, 2018; Adrogue & Orlicki, 2013; Kleiman, 2011; Buttenheim, et al, 2011). McEwan (2010) used regression-discontinuity design while Ayoola (2014) employed a combination of linear regression model and descriptive methods.

There is a universal agreement in the literature in terms of the variables or indicators that constitute education, nutrition, health and agricultural outcomes. Education indicators are mainly: school enrolment, school attendance, school dropout, school completion, and learning outcomes measured with mathematics and language test scores. The nutrition indicators are: malnutrition, stunting and wasting, measured with height-for- age and weight-for-age. The health indicators are mainly: deworming, anemia, polio, malaria, meningitis and sanitation. Agriculture indicators mainly agricultural production. Previous studies also looked at disparities between boys and girls in education, health and nutritional outcomes.

Ayoola (2014) studies the impact of School Feeding Programme on educational indicators and social skills in Osun State primary schools of Nigeria. The study employs Multi-stage sampling technique to choose 450 students from primary two in Osun state, and 450 students from primary two in Oyo state. Also, 450 parents, of the students from Osun state, 45 classes of primary four, 45 head teachers, 109 stakeholders and 60 cooks were also chosen.

The study administered seven instruments comprising school resources inventory, school feeding programme operators' questionnaire, parents' perception of the school feeding programme, standard balance beam scale physically utilized to measure student's empowerment achievement test in numeracy, weight and height. The analysis the data using descriptive and inferential statistics at p < 0.05.

The results show that average enrolment in primary two increased by 19.2 percent, attendance rate also rose by 9 percent and retention rates also increased by 3 percent. School enrolment, attendance, were significantly higher in intervention schools with t-statistic >2 each. There was no difference in Boys' and Girls' enrolment in intervention schools, while Boys' and Girls' enrolment in non-intervention schools were significantly different, t-statistic = 2.08. Girls' attendance was significantly higher in intervention schools, while Boys' attendance was significantly higher in non-intervention schools. There was higher nutrition status for pupils in intervention schools. In respect to academic achievement, intervention schools were significantly higher in numeracy and literacy. Girls in intervention schools were significantly higher in numeracy and literacy. Girls in non-intervention schools were also higher in numeracy but no difference in literacy achievement between the Boys' and Girls. Girls nutrition status was higher than Boys' in intervention schools. Parents and stakeholders indicated satisfaction with the implementation of the programme. Cooks' income level also showed significant increase and also improved their purchasing skills. The study concludes that the school feeding programme in Osun State made a positive impact on pupils' enrolment, attendance, retention, nutrition status and academic achievement and benefited a wide range of stakeholders. The study recommends that the programme should be replicated in non-implementing states and sustained beyond primary two pupils (Ayoola, 2014).

A case study of Botswana's National Primary School Feeding Programme (NPSFP) undertaken by Botswana Institute of Development Policy Analysis (BIDPA) in collaboration with New Partnership for Africa's Development (NEPAD), Partnership for Child Development (PCD), World Food Programme (WFP), and World Bank in 2013, revealed that Botswana operates a school feeding programme that provides a meal per day to a total of 330,000 schoolchildren in all the country's public primary schools. They study revealed that NPSFP resulted to a rise in school attendance, enrolment rates, transition rates, and improved the children's daily nutrition needs.

The World Bank & Human Development Network, (2012) study two African countries and one Asian country, namely: Uganda, Burkina Faso, and Lao People's Democratic Republic,

The World Bank in conjunction with The UN World Food Programme (WFP) evaluated the impact of school feeding and take-home rations Programmes in these countries between 2006-2008. The study proceeded as narrated below:

Schoolchildren were chosen from the northern Sahel region in Burkina Faso, where the WFP handled take-home rations and in-school meals programmes in the 2005-2006 academic year. The study examined the outcome of 46 new schools included into the programme in the year. The schools were randomly distributed to 1 of 3 groups, 1/3 received take-home rations, 1/3 had on-site feeding programmes and 1/3 was the control group. A baseline household survey was done in in 2006, and results were collated during the 2006-2007 academic year, with a follow-up survey done in 2007. A total of about 4,236 students aged 6-15 were taken from a random sample of villages in the different groups. Educational outcome tests were also carried out. The results show that was a 25% increase in school enrolment rates. Therefore, this improvement in enrolment rates can be attributed to in-school meals and take-home rations programmes. Also, there was a 3-4% increase in enrolment rates of both girls and boys that received on-site breakfasts and or lunches. On the hand, administering take-home rations on female students who had a 90% attendance rate increased enrolment rate. Females' enrolment grew by 5%, and Males' enrolment rate from the same families also increased 3.3%. However, the benefit in males' enrolment rate was statistically insignificant, meaning that the programme did not reduce male's enrolment rate and again revealed a positive spill-over effect for mles in households where a girl's enrolment resulted to additional food. The study finds mixed results for educational benefits. Females enrolled in schools with a feeding programme indicated marginal increases in scores on math tests, however there was no significant impact for males. Before commencement of the programme, schoolchildren showed severe nutritional problems. This position did not quite change after the programme was administered. However, younger siblings who were disadvantaged or more nutritionally vulnerable did gain from the take-home rations, as indicated by weight-for-age. The study concluded that the take home rations are not just consumed by the students but also shared with their younger siblings (World Bank & Human Development Network, 2012).

Evaluation of school-feeding programme in Uganda operated by WFP for children in Internally Displaced People camps in two districts of northern Uganda. 31 camps were chosen randomly, and the camps were also randomly selected into 1 of 3 groups- take-home rations, in-school feeding or a control group. A baseline survey was carried out in 2005, prior to implementation of the feeding programme in 2006, and a follow-up survey was implemented in 2007. The survey concentrated on households with children between the ages of 6 and 17years. Learning outcome tests were carried out and also unannounced attendance measures. In-school meals included a fortified snack and lunch. Take-home rations, given once a month, equalled the food that was given to students in the school meals programmes and was available to children with an attendance rate of at least 85%. The Results indicates that enrolment rates went up even where enrolment rates were already above 80% when the feeding programme commenced. Ugandan authorities abolished primary school fees in 2002 to encourage school participation. The result is that in-school meals rose enrolment by 9% for children who were of school age and had not been enrolled the programme started. Evidence available for children who were eligible for take-home rations shows that increase in school enrolment was not that obvious. Perhaps the rations, unlike meals in school, were controlled and administered by the child's caregivers, maybe limiting the gains of the food for the child and therefore reducing the child's enthusiasm to attend school. The study finds that schoolchildren who qualified for rations did not bring meals or snacks to school, which perhaps indicates they were still hungry, at least during the school day. The study also investigated school attendance, in addition to school enrolment. The results showed a significant rise in attendance for females in schools that offered on-site meals and rise in attendance rates for older boys between the ages 10 and 17years in schools that offered take-home rations. In the two instances, attendance went up by 8-12%. Male students were less likely to repeat a grade, but the female students had no noticeable effect. The younger siblings of students who qualified for take-home rations did not show any benefit in terms of nutritional status, based on weight-for-age and height-for-age measurements. Anemia rates among females who were in their puberty stage reduced. anemia among females between the age of 10 and 13years who qualified for the feeding programme was less than among females in the control group by 20%. The drop-in anemia points to the risks of anemia among

females once they get to puberty stage and a way to minimize it (World Bank & Human Development Network, 2012).

There are similarities among the programme in Lao People's Democratic Republic, Burkina Faso, and Uganda. A group of schools offered snacks in school to children attending classes; another group of schools gave rations of rice and canned fish to students who had at least 80% attendance. But in Lao People's Democratic Republic, villages also created a feeding committee, built storage facilities, provided the labour to prepare the food and, and occasionally traveled to the distribution centers to get the food. The evaluation in Lao People's Democratic Republic was constrained by the programme's poor implementation rates (World Bank & Human Development Network, 2012).

A study carried out in Brazil shows that 30% of all food items bought for school feeding came from smallholder farmers (Drake et al, 2016), in (Bundy, et al, 2018).

Herrero, et al, (2017) finds that farms less than 2 hectares produce greater than 25percent of nutrients for East Asia Pacific, Southeast Asia, South Asia, and Sub-sharan Africa (Herrero, et al, 2017), in (Bundy, et al, 2018).

Singh & Fernandes, 2018 studies in Ghana indicates that bulk of the demand for agricultural commodities from home-grown school feeding programme for various food types is key to promoting production diversity. For instance, the upper bound estimates for legumes is more than 25,000 tons, representing about 2.85% of country's legume production (Singh and Fernandes, 2018), in (Bundy, et al, 2018).

Buttenheim, et al (2011) studies the Impact of School feeding programmes in Lao People's Democratic Republic. The study employed DID estimation alongside propensity-score weighting. The results show low evidence of increase in enrolment rate. Again, the study reveals that the programme had no positive effect on nutritional status of the children (Buttenheim, et al,2011).

A study of Kenyan School Meal by Guleid, et al (2010) revealed that the programme achieved higher enrolment and attendance Higher primary completion rates particularly for girls Higher scores in last primary school exams Better nutrition intake Multiple Safety net effects Economics benefit- leaving children at school

frees to expand income-earning activities (Guleid, et al, 2010).

Kleiman (2011) examines the role of school feeding programmes in ending childhood hunger in 18 Randomized studies (9 were done in Low income countries). The results show that students who ate at school gained 0.39-0.71kg more weight over 11-19 months and also gained more height. School attended rose by 4-6 days per year (in poor income countries). Also, the maths score and short-term cognitive task were better.

Mazinga (2010) finds the linkages among school feeding, school health, nutrition, and domestic agricultural production in Malawi, Increases enrolment, attendance and retention. Also leads to reduction in gender disparities.

Mukanyirigira (2010) studied WFP Rwanda School Feeding Programme. The programme provided nutritious daily cooked foods at school canteens (maize, beans, oil and salt). Equipped schools with kitchen infrastructures. Made available health services at school. Provided agricultural tools and livestock to schools in most vulnerable area. Organized exchange visits among schools. The results shows that attendance rate improved from 68.5% in 2003 to 96% in 2008, drop-out rate improved from 21% in 2003 to 2% in 2008, increased children's ability to concentrate and learn better, confirmed by 94% of interviewed school teachers (Mukanyirigira, 2010).

A study by Tanzanian Ministry of Education and Vocational Training in conjunction with World Food Programme in 2010 on Tanzanian School Feeding revealed achievement of net enrolment ratio of 97%. Achievement of daily attendance of 90%. Reduction of drop-out rates to less than 3%. Increase in academic performance with 70% pass rate.

Ahmed (2004) investigates the effects of Bangladesh's school feeding programme using Difference-in-Difference econometric modelling. "The school feeding programme avails a morning snack comprising of 8 quality wheat biscuits to 1 million students in about 6,000 primary schools in acute food insecure regions, in addition to 4 slum regions in Dhaka City. A pack of 8 biscuits cost United States 6 cents. The biscuits give 300 kilocalories and 75% of vitamins and minerals recommended daily. The study finds that the school feeding programme increased enrolment

by 14.2%, the probability of school dropout also declined by 7.5%, while attendance rose by 1.3 days monthly. Also, the programme also improved academic achievement. Participants in the programme also reported better test scores by 15.7%. The result also revealed that mathematics score also improved among participating students (Ahmed, 2004).

McEwan (2013) evaluates the effects of school feeding program on education outcomes in Chile. The study employed regression-discontinuity design to collect data of enrolment, attendance, grade 1 enrolment age, grade repetition, and grade 4 test scores. The results show no evidence that the policy improves primary school participation and test scores.

Adrogue & Orlicki (2013) estimates the effect of school feeding programmes on academic achievements in public schools in Argentina, using standardized test scores in addition to a DID model. The results reveal slight improvement in school achievement. However, statistically significant improvement was seen only in language test scores, but no significant effects was seen in mathematics score.

3. METHODOLOGY

3.1 The Study Area

The study covers 35 states in Nigeria where the HGSF programme has been implemented, alongside the Federal Capital Territory (FCT). The focus is on both urban and rural areas, particularly those with a large population of smallholder farmers whose agricultural output is linked to the feeding programme.

3.2 The Design & Model

The study employs a quasi-experimental design to evaluate the impact of the Home-Grown School Feeding Programme (HGSF) on schoolchildren and smallholder farmers in Nigeria. This approach compares educational and agricultural outcomes in communities where the programme is implemented (intervention group) and those where it is not (control group). The study c, which measures the effect of the programme by comparing changes in outcomes over time between treated and untreated groups.

Suitable model for topic of study is cc primarily, in line with previous studies (Chakraborty and Jayaraman, 2019; Nikiema, 2019; Adrogue and Orlicki; 2013, Buttenheim et al.; 2011; Osei-Fosu; 2011; Ahmed, 2004). The DID method compares a treatment and control group before and after an intervention. Let A be a control group, and B, a treatment group, the DID model is specified as follows:

$$Y_{it} = \alpha_0 + \alpha_1 B_{it} + \alpha_2 K_{it} + \alpha_3 K.B_{it} + \mu_{it}, \qquad (1)$$

where Y_{it} is the outcome of interest for the individual at time t, α_1 represents the differences between treatment and control groups before and after the intervention, K_{it} is a vector of control variables that cause a change in Y_{it} overtime even in the absence of the intervention, and μ_{it} is the error term, which represents other variables not captured explicitly in the model.

The DID can be specified as:

$$\hat{\Delta} = (\bar{Y}_{B_2} - \bar{Y}_{B_1}) - (\bar{Y}_{A_2} - \bar{Y}_{A_1}) \qquad (2)$$

Where $\hat{\Delta}$ represents the average treatment effect (ATE), $\bar{Y}_{B_1}$ and $\bar{Y}_{A_1}$ denote outcomes before treatment and $\bar{Y}_{B_2}$ $\bar{Y}_{A_2}$ denote outcomes after treatment.

To evaluate the impact of HGSF programme on agricultural productivity of smallholder farmers of the benefiting communities, we will use the transcendental logarithm Production function or Translog production function, used initially by Christensen et al. (1973). The Translog production function is specified as follows:

$$Q_i = f(K_i, L_i, T) = A_i K_i^b L_i^c \qquad (3)$$

Where Q_i, K_i, and L_i represent gross value-added, capital stock, and labour respectively for any sector *i* and *T* denote time. The coefficients *b* and *c* measure degree of returns of relevant inputs.

In a simplified fashion a three-input production function can be specified with second-order Taylor expansion approximation as follows:

$$\ln Q_i = \beta_0 + \beta_1 K \ln K + \beta_2 L \ln L + \beta_3 T \ln T + \tfrac{1}{2}\beta_4 KK (\ln K)^2 + \beta_5 KL \ln K.\ln L$$

$$+\beta_6 KT \ln K \ln T + \tfrac{1}{2}\beta_7 LL (\ln L)^2 + \beta_8 LT \ln L \ln T + \tfrac{1}{2}\beta_9 TT (\ln T)^2 + v_i \qquad (4)$$

Where Q_i = output variable, β_0 = constant term, β_1, β_2, … , β_9 are coefficient variables measured, K, L, and T = input variables, and ν_i = error term.

The parameters β_0, β_1, β_2, …, β_9 can be estimated using OLS.

The econometrics Translog production model for this study is specified as follows:

$$\ln Q_i = \lambda_0 + \lambda_1 \ln(X_1) + ... + \lambda_6 \ln(X_6) + \tfrac{1}{2}[\lambda_7 \ln(X_1)^2 + ... + \lambda_{12}(X_6)^2]$$

$$+\lambda_{13}\ln(X_1)\ln(X_2) + ... + \lambda_{18}\ln(X_5)\ln(X_6) + \omega D + \delta_t + \upsilon_i \quad (5)$$

Where Q_i = Agricultural output, X_1 = Farm Implements, X_2 = Farm Labour, X_3 = Farm Size, X_4 = Fertilizer Application, X_5 = Insecticide Application, X_6 = Age of Farmer, D = Access to Home-grown school feeding programme, δ_t = Seasonal variations., and υ_i = Error term. λ_0 = constant term. $\lambda_1, \lambda_2...., \lambda_{18}$ = slope coefficients. ω = impact of HGSF programme.

4. RESULTS AND DISCUSSION

Table 1. Estimated OLS Regression Result

| Dep. Variable:	Agricultural_Output	R-squared:	0.096	P>|t|	[0.025	0.975]
Model:	OLS	Adj. R-squared:	0.038			
Method:	Least Squares	F-statistic:	1.643			
Date:	Sat, 26 Oct 2024	Prob (F-statistic):	0.144			
Time:	12:51:31	Log-Likelihood:	-924.40			
No. Observations:	100	AIC:	1863.			
Df Residuals:	93	BIC:	1881.			
Df Model:	6					
Covariance Type:	nonrobust					
	coef	std err	t	P>|t|		
Intercept	7719.7273	1567.153	4.926	0.000	4607.673	1.08e+04
Treatment	1.826e-10	3.7e-11	4.928	0.000	1.09e-10	2.56e-10
Time	1.857e-10	3.77e-11	4.925	0.000	1.11e-10	2.61e-10
DID	-2.548e-11	5.17e-12	-4.930	0.000	-3.57e-11	-1.52e-11
Farm_Implements	-57.3140	100.631	-0.570	0.570	-257.146	142.518
Farm_Labour	14.7027	42.662	0.345	0.731	-70.015	99.420
Farm_Size	26.2573	19.777	1.328	0.188	-13.016	65.531
Fertilizer_Application	-5.7380	1.985	-2.891	0.005	-9.679	-1.797
Insecticide_Application	-9.0732	4.969	-1.826	0.071	-18.940	0.794
Age_of_Farmer	0.7799	23.851	0.033	0.974	-46.583	48.143
Omnibus:	15.981	Durbin-Watson:	2.082			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	0.103	4.539		
0.000						
Skew	-0.085	Prob(JB):	0.103	0.103		
Kurtosis:	1.970	Cond. No.	3.21e+18			
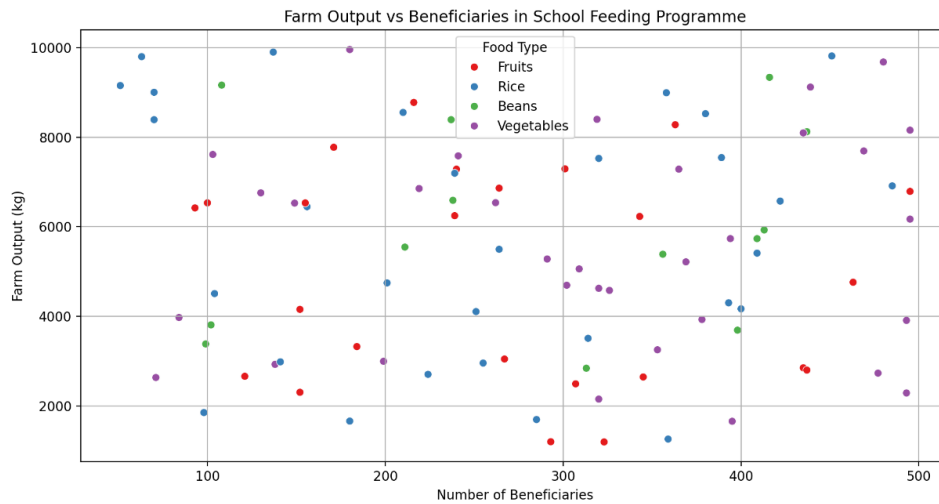
Fig. 1. Farm output Vs beneficiaries in school feeding programme

This study employed a difference-in-differences (DID) approach to evaluate the impact of the home-grown school feeding programme (HGSF) on agricultural output. The analysis included a treatment group with access to the HGSF and a control group without access, allowing for a comparative assessment of changes in agricultural output over time. The regression results indicate that the model explains approximately 9.6% of the variability in agricultural output (R-squared = 0.096). The coefficients for the treatment and interaction terms provide insights into the effectiveness of the HGSF program. Notably, the coefficients for the treatment variable suggest a positive impact on agricultural output, although the statistical significance of these effects varies.

Further investigation into the coefficients reveals the following; the intercept represents the baseline agricultural output for the control group. The treatment effect indicates the difference in agricultural output attributable to the HGSF programme. The interaction term captures the differential impact of the programme over time.

Previous research has shown that school feeding programmes can enhance agricultural productivity by increasing demand for local produce (Alderman & Bundy, 2012). This aligns with our findings, which suggest a positive treatment effect from the HGSF programme. Studies by Pandey, et al (2016) reveals that agricultural interventions, particularly those aimed at improving food security, can lead to significant increases in output. Our analysis supports this notion, indicating that access to HGSF may contribute to improved agricultural

outcomes. The use of the DID approach is well-documented in evaluating policy impacts (Angrist & Pischke, 2009). This methodology allows for a robust comparison between treatment and control groups, providing a clearer picture of the programmes effectiveness.

5. CONCLUSION

In conclusion, to be able to sufficiently disaggregate School feeding programme, smallholder farmers and the development of rural areas in Nigeria, this study looked at each of the components as a stand-alone, and again looked at their interrelationships, interdependences, and interactions. The federal government of Nigeria, under the administration of Muhammadu Buhari, attempted to develop rural areas in Nigeria by introducing the school feeding programme in order to boost local agricultural production, create employment opportunities, reduce out-of-school children, improve nutrition and health status of children, and improve the economic wellbeing of the rural areas as a strategy to grow and develop the Nigerian Economy. Virtually all the studies reviewed find that the school feeding programme has a positive impact on education outcomes, agricultural outcomes, and nutrition and health outcomes. However, there is no existing rigorous empirical evidence on the impact of HGSF programme in Nigeria to guide policy, especially since its relaunch in 2016. Existing studies (such as, Bosah et al., 2019; Akorede and Olaleye, 2019; Taylor and Ogbogu, 2016; Ayoola, 2014) are descriptive, and each of these studies focused on just one state or local government Area. We need to empirically establish the nation-wide impact of the policy

given the huge amount of money invested into the programme since it was implementation in the whole states of the federal or alternatively, disaggregate them into the six geo-political zones in Nigeria. This gap is suggested for further study.

CONSENT

Ethical guidelines are followed to ensure the protection of children and vulnerable groups. Informed consent is obtained from parents and guardians for students participating in the study. Anonymity and confidentiality are maintained for all respondents. The study follows institutional ethical review protocols to protect the rights and welfare of all participants.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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